

NEONATAL CIRCUMCISION REVISITED

Fetus and Newborn Committee, Canadian Paediatric Society

Abstract • Résumé

- Objective:** To assist physicians in providing guidance to parents regarding neonatal circumcision.
- Options:** Whether to recommend the routine circumcision of newborn male infants.
- Outcomes:** Costs and complications of neonatal circumcision, the incidence of urinary tract infections, sexually transmitted diseases and cancer of the penis in circumcised and uncircumcised males, and of cervical cancer in their partners, and the costs of treating these diseases.
- Evidence:** The literature on circumcision was reviewed by the Fetus and Newborn Committee of the Canadian Paediatric Society. During extensive discussion at meetings of the committee over a 24-month period, the strength of the evidence was carefully weighed and the perspective of the committee developed.
- Values:** The literature was assessed to determine whether neonatal circumcision improves the health of boys and men and is a cost-effective approach to preventing penile problems and associated urinary tract conditions. Religious and personal values were not included in the assessment.
- Benefits, harms and costs:** The effect of neonatal circumcision on the incidence of urinary tract infection, sexually transmitted diseases, cancer of the penis, cervical cancer and penile problems; the complications of circumcision; and estimates of the costs of neonatal circumcision and of the treatment of later penile conditions, urinary tract infections and complications of circumcision.
- Recommendation:** Circumcision of newborns should not be routinely performed.
- Validation:** This recommendation is in keeping with previous statements on neonatal circumcision by the Canadian Paediatric Society and the American Academy of Pediatrics. The statement was reviewed by the Infectious Disease Committee of the Canadian Paediatric Society. The Board of Directors of the Canadian Paediatric Society has reviewed its content and approved it for publication.
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- Objectif :** Aider les médecins à conseiller les parents au sujet d'une circoncision néonatale.
- Options :** Recommander ou non une circoncision de routine des nouveau-nés de sexe masculin.
- Résultats :** Coûts et complications de la circoncision néonatale, effet des infections des voies urinaires, des maladies transmises sexuellement et du cancer du pénis chez les garçons et les hommes circoncis et non circoncis, et du cancer du col chez leur partenaire, et coûts du traitement de ces maladies.
- Preuves :** Le Comité d'étude du fœtus et du nouveau-né de la Société canadienne de pédiatrie a recensé la documentation sur les circoncisions. Au cours des longues discussions que le comité a eues pendant ses rencontres au cours d'une période de 24 mois, il a examiné soigneusement la validité des preuves afin de se faire une idée du problème.

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Valeurs : On a examiné la documentation pour savoir si la circoncision néonatale améliorait la santé des garçons et des hommes et si elle constituait une technique rentable pour prévenir les problèmes du pénis et d'autres états liés aux voies urinaires. L'évaluation n'a pas tenu compte des principes religieux ou personnels.

Avantages, préjudices et coûts : L'effet de la circoncision néonatale sur l'incidence des infections des voies urinaires, des maladies transmises sexuellement, du cancer du pénis, du cancer du col et des problèmes du pénis; les complications de la circoncision; l'estimation des coûts de la circoncision néonatale et du traitement d'états ultérieurs du pénis, d'infections des voies urinaires et de complications découlant de la circoncision.

Recommandation : La circoncision des nouveau-nés ne devrait pas être faite systématiquement.

Validation : Cette recommandation est conforme aux énoncés antérieurs de la Société canadienne de pédiatrie et de l'American Academy of Pediatrics sur la circoncision néonatale. Le Comité des maladies infectieuses de la Société canadienne de pédiatrie a revu cet énoncé. Le Conseil d'administration de la Société canadienne de pédiatrie a revu le contenu de cette recommandation et l'a approuvé pour publication.

Commanditaire : Il s'agit d'un énoncé officiel de la Société canadienne de pédiatrie. Ni la Société canadienne de pédiatrie ni aucun de ses membres n'ont reçu d'aide financière de l'extérieur pour la rédaction d'une partie ou l'autre de cet énoncé.

Circumcision is one of the procedures performed most often on males. It was estimated in 1970 that 69% to 97% of all boys and men in the United States had been circumcised, in comparison with 70% of those in Australia, 48% of those in Canada and 24% of those in the United Kingdom.¹ The procedure is uncommon in northern European countries, Central and South America and Asia.¹

In 1971 and 1975 the American Academy of Pediatrics (AAP) took a stand against the routine circumcision of newborns on the basis that there are no valid medical indications for circumcision in the neonatal period.^{2,3} In 1975 the Fetus and Newborn Committee of the Canadian Paediatric Society (CPS) reviewed the literature available at that time and reached the same conclusion.⁴ In 1983 this position was reiterated by the AAP and the American College of Obstetricians and Gynecologists in their joint publication *Guidelines for Perinatal Care*.⁵ The CPS Fetus and Newborn Committee re-examined the issue in 1982, in response to an article on the benefits and risks of circumcision,⁶ and saw no reason to modify its 1975 statement.⁷

In 1989 a multidisciplinary Task Force on Circumcision established by the AAP summarized the evidence for and against the routine circumcision of newborns but did not make a specific recommendation.⁸ The evidence the task force reviewed on the status of circumcision of newborns and the question of routine neonatal circumcision was subsequently discussed in commentaries by the chairman of the task force and by one of its members.^{9,10} Considerable discussion followed in the letters to the editor of the two journals in which these appeared.¹¹⁻¹⁷

There have continued to be articles published presenting arguments supporting and opposing routine neonatal circumcision.¹⁸⁻²⁶ Detailed estimates of the financial and medical advantages and disadvantages have been made.^{27,28}

Groups opposed to neonatal circumcision have been formed and have become visible lobbyists (for example, the National Organization to Halt the Abuse and Routine Mutilation of Males, San Francisco, and the National Organization of Circumcision Information Resource Centers based in San Anselmo, Calif., with branches across the United States and in Canada and other countries).²⁹ It therefore seemed appropriate for the Fetus and Newborn Committee of the CPS to revisit the subject.

Articles on circumcision published between 1982 and 1992 were identified from *Index Medicus*, and articles published from 1988 to 1994 were found through MEDLINE searches. Relevant articles were also identified from the bibliographies of the AAP task force statement,⁸ the subsequent commentaries and other review articles. The reference lists of identified articles were searched for additional publications. A total of 671 published articles on circumcision were identified. Case reports, case-control studies, cohort studies, randomized controlled trials and two meta-analyses were identified and included. No randomized controlled trials of circumcision per se were identified; the only randomized controlled trials found involved the use of analgesia or anesthetic agents during circumcision. Of the articles identified, 61 concerned urinary tract infections (UTIs) and circumcision, 23 involved the relation between male circumcision and HIV status and 25 discussed the pain caused by circumcision and the use of analgesia. Articles reviewed were restricted to those in English, except for one article in Spanish.

We asked the following questions. What is the effect of routine circumcision of newborn male infants on the rate of UTI, sexually transmitted diseases, cancer of the penis, cervical carcinoma and penile problems? What is its effect on health care costs? Is the balance of evidence sufficient to warrant a change in the position taken by the CPS in 1982?⁷

WHAT IS THE PREPUCE?

The prepuce is described anatomically as a simple fold of skin.³⁰ Its function has been assumed to be protection of the glans. There are unwritten assumptions in the literature discussing circumcision. However, a recent report has described numerous oval, rounded or elongated nerve corpuscles in the inner mucosal surface of the prepuce.³¹ These are similar to nerve endings seen, although less frequently, in the glans and the frenulum. Their function is unknown. The author of the report speculated that this specialized sensory tissue may perform different functions at different times of life and may be involved in sexual responses in adults. The presence of these nerve endings also emphasizes the need for pain control when circumcision is performed.

URINARY TRACT INFECTION

An association between an increased incidence of UTI and uncircumcised status has been reported. In 1982 Ginsburg and McCracken³² reported a case series of 109 infants in whom UTI developed between 5 days and 8 months of age. Male infants predominated in their series; of these, 95% were uncircumcised.

In 1985 Wiswell, Smith and Bass³³ reviewed a cohort of 5261 infants born at an army hospital and found a higher incidence rate of UTI among the uncircumcised male infants (4.12%) than among those who were circumcised (0.21%). A subsequent review of the records of 427 698 infants (219 755 of whom were boys) born in US Armed Forces hospitals from 1975 to 1979 supported these findings, showing a 10-fold higher incidence rate of UTI among uncircumcised boys (1.03%) than among circumcised boys (0.10%).³⁴ By comparison, the incidence rate among the female infants was 0.52%. In addition, the investigators reported a temporal association between a decrease in the circumcision rate and an increase in the UTI rate among boys in the early 1980s. There was no concurrent change in the incidence among girls, and the ratio of the incidence of UTI among boys to that among girls during early infancy shifted toward a predominance among boys.³⁴

A later review of UTI among 209 399 infants born between 1985 and 1990 in US Army hospitals worldwide found that 1046 infants, of which 496 were boys, had been admitted to hospital for UTI in the first year of life.³⁵ There was a 10-fold greater incidence of infection among the uncircumcised than among the circumcised boys. Among the uncircumcised boys younger than 3 months of age, the incidence rate of concomitant bacteremia caused by the same organism that caused the UTI was 23%. The diagnosis of UTI in all of these studies was made on the basis of culture of urine samples ob-

tained by bladder tap or by catheter. These studies are retrospective, and therefore some caution must be exercised in their interpretation. A potential bias in these studies is that patients were admitted to hospital because of the infections; since infections not requiring hospital treatment were excluded, the true incidence may have been underreported.

Herzog,³⁶ in an evaluation of febrile infants seen in an outpatient clinic, also showed a higher incidence of UTI among uncircumcised boys than among those circumcised. The authors of two review articles each concluded that the circumcision of newborns reduced the incidence of UTI.^{37,38} Despite the impressive magnitude of the decrease in the incidence of UTI (10-fold or more) associated with circumcision, when one recognizes the low overall incidence rate of UTI among infant boys (1% to 2%), several questions arise. Is universal circumcision warranted for the prevention of UTI? What are the risks and the costs of this approach? Are there any alternative strategies for the prevention of UTI that should be evaluated?

There is a plausible explanation for the association of UTI with uncircumcised status. The explanation involves colonization of the prepuce with bacteria in infancy and childhood. Several bacteria, including fimbriated strains of *Proteus mirabilis*, nonfimbriated *Pseudomonas*, *Klebsiella* and *Serratia* species³⁹⁻⁴¹ and pyelonephritogenic fimbriated *Escherichia coli*,^{39,41,42} have been shown to bind closely to the mucosal surface of the foreskin within the first few days of life. It has been suggested that circumcision protects male infants from UTI by preventing the bacterial colonization of the prepuce and subsequent ascending infection.³⁷

In natural settings, infants are often subject to colonization at birth with the aerobic and anaerobic flora of their mothers; they also receive specific immunoglobulin across the placenta before delivery and, later, through ingestion of breast milk. In contrast, babies born and cared for in hospital tend to be colonized by *E. coli* acquired from the environment.^{43,44} The virulence of *E. coli* strains isolated in cases of UTI is correlated with the ability of the strain to adhere to uroepithelial cells.⁴⁵ This ability has been shown to be associated with the presence on the bacteria of proteinaceous, filamentous organelles called fimbria, which appear to recognize and bind to specific receptors on the epithelial cells.⁴⁵ Kallenius and associates⁴⁶ reported that 94% of the cases of infantile pyelonephritis they reviewed were due specifically to P-fimbriated *E. coli*.

On the basis of these observations, Winberg and collaborators⁴⁷ suggested two alternative preventive strategies: deliberate colonization with nonpathogenic bacterial flora during the newborn period or the promotion of rooming-in to facilitate close contact between newborns and their mothers. The first strategy is analogous to the

active colonization of the umbilicus and nasal mucosa undertaken in the past to arrest epidemics of infection with *Staphylococcus aureus*.⁴⁸

These two strategies need to be evaluated further. One would expect both to have a low risk of complications. The second is in keeping with recent trends in maternal and infant care and could also have a low cost. If either strategy is successful, it may prove to be a more cost-effective way to prevent UTI among male infants than circumcision. Such an approach could also be applied to the prevention of UTI in female infants, since adherence of bacteria to epithelial cells also plays a role in the development of UTI in girls.⁴⁵

There has been one report of a case-control study of breast-feeding and UTI among infants.⁴⁹ In the study, 47% of 62 infants presenting with a UTI had been breast-fed, whereas 82% of 62 control infants seen at a well-baby clinic and 87% of 62 control infants admitted to hospital because of fever had been breast-fed, and none of the control infants had a UTI ($p < 0.001$). No information was given about alterations in the bacterial flora of the infants in the study.

A meta-analysis has been made of six articles containing original patient data on circumcision and UTI.⁵⁰ In a sample of 221 799 patients the odds ratio (OR) of UTI among uncircumcised male infants compared with circumcised male infants was 13.1 (95% confidence interval [CI] 10.9 to 15.7). A second meta-analysis of nine studies of the circumcision status of boys with UTI, which included the six articles covered by the first meta-analysis, reported an OR of 12.0 (95% CI 10.6 to 13.6).³⁵

However, the risk of UTI among the uncircumcised boys during the first year of life was low enough that the first set of authors felt that routine neonatal circumcision was not justified.⁵⁰ The authors of the second analysis emphasized the importance of discussing the association between UTI and uncircumcised status while counselling parents about neonatal circumcision to obtain their informed consent.³⁵

EFFECT OF TIMING OF CIRCUMCISION

An epidemiological study of UTI during the first year of life involving 169 children born in Israel found that 48% (27/56) of the male infants presented with UTI within 12 days after ritual circumcision.⁵¹ The incidence of UTI among male infants was significantly higher just after circumcision (from 9 to 20 days of life) than during the rest of the first month of life and significantly higher in the first month of life than during the rest of the year. After the immediate postcircumcision period, the incidence rate of UTI dropped to a level comparable to that reported among circumcised male infants in the United

States. Among the 113 female infants, the episodes of infection were evenly distributed throughout the first year of life, except that the incidence was lower during the first month. This study suggests that the method and the timing of circumcision also may be important factors to consider.

CIRCUMCISION AND UTI AMONG YOUNG ADULTS

In a retrospective case-control study, 26 men with symptomatic UTI confirmed by microbiological analysis were compared with 52 men who had urinary symptoms but negative results of cultures from urine specimens.⁵² The groups were similar with respect to age, race and sexual activity. Of the men with a UTI, 31% (8/26) were uncircumcised, whereas 12% (6/52) of the men without a UTI were uncircumcised ($p = 0.037$, OR 5.6, 95% CI 1.6 to 19.4).

IDENTIFICATION OF URINARY TRACT ABNORMALITIES

In the case-control study by Herzog,³⁶ in 8 of the 31 patients who underwent radiographic investigation, abnormalities were found. Four of the patients had grade II reflux, two had grade IV reflux, one had posterior urethral valves with hydronephrosis, and one had ureteropelvic junction obstruction with hydronephrosis. Amir, Varsano and Mimouni⁵³ found anomalies of the urinary tracts of three out of eight patients who had a UTI after ritual circumcision. It has been suggested that not circumcising male infants is, therefore, advantageous because it allows early identification of infants who have structural abnormalities that require surgical intervention or close medical follow-up.^{54,55} Whether the reflux found in the patients in the case-control study was acquired or was a result of a congenital lesion, as suggested by Rockney and Caldamone,⁵⁴ is unknown.

SEXUALLY TRANSMITTED DISEASES

A higher risk of nongonococcal urethritis among circumcised men than among uncircumcised men has been described.⁵⁶ A recent cross-sectional study of 300 consecutive heterosexual male patients attending a sexually transmitted diseases (STD) clinic showed that circumcision had no significant effect on the incidence of common STDs.⁵⁷ However, a significantly greater incidence of STDs — including genital herpes, candidiasis, gonorrhea and syphilis — among men who were not circumcised than among those who were circumcised has been previously reported.⁵⁸ Uncircumcised status and diseases causing genital ulceration have been reported to be risk factors in the transmission of HIV to heterosexual men.^{59,60} A recent review of the literature on the associa-

tion between circumcision status and the risk of HIV infection included 30 epidemiological studies, of which 15 were published articles and 15 were abstracts presented at conferences.⁶¹ Twenty-six of these studies were cross-sectional, two were prospective and two ecological in design. One of the latter estimated the seroprevalence of HIV in the general population of 37 African capital cities and correlated these data with the estimated national proportions of uncircumcised males. The other related data on HIV seroprevalence from 140 discrete geographic locations in Africa to the usual male circumcision practices in those areas. Both showed positive associations. Eighteen of the cross-sectional studies reported a statistically significant association, determined through univariate or multivariate analysis, between the presence of the foreskin and the risk of HIV infection. Four other such studies showed a trend toward an association, and four showed no association. The two prospective studies showed positive associations. The ORs or relative risks (RRs) calculated in the studies that showed statistically significant associations ranged from 1.5 to 8.4. However, an editorial review of 26 studies on this subject (including 23 of the previously reviewed studies) commented on the lack of a distinction between susceptibility and infectivity, the use of inadequate controls for confounding variables, potential selection biases, and misclassifications of exposure or inappropriate choices of comparison groups, each of which may lead to an incorrect estimation of the association.⁶² The authors of this review also commented that the use of an OR rather than RR in several of the studies may have led to an overestimation of the association, which would incorrectly suggest a causal relation. They judged that further studies were required to ascertain the RR associated with the lack of circumcision before considering interventional studies.

CANCER OF THE PENIS

The incidence rate of cancer of the penis is 0.3 to 1.1 per 100 000 men per year in developed countries and 3 to 6 per 100 000 men per year in developing nations.^{63,64} In the United States the incidence rate is less than 1 per 100 000 per year. This is similar to the rates in Norway and Sweden, where circumcision is rarely performed.⁶⁴⁻⁶⁷ Among uncircumcised men in the United States, the incidence rate is 2.2 per 100 000 per year.⁶⁸ Only a few cases have been reported among men who were circumcised as newborns.⁶⁹⁻⁷² In two reported studies, human papillomavirus (HPV) types 16 and 18 were found in 58% (31/53) and 49% (33/67) of cases of penile cancer, respectively, which suggests that this virus plays a causal role in penile cancer.^{73,74}

A recent population-based case-control study in-

involved 110 men with penile cancer who were available and consented to participate, from a total of 219 men diagnosed with this condition, and 355 controls who were successfully interviewed, from a total of 481 eligible men. The controls were matched with the case subjects in a 2:1 ratio by 5-year age groups and the year of diagnosis.⁷⁴ The authors found that the RR of penile cancer was 3.2 for uncircumcised men compared with circumcised men (95% CI 1.8 to 5.7). However, other factors were also found to be associated with an increased risk of penile cancer. The RR was 2.8 (95% CI 1.4 to 5.5) among men who currently smoked compared with men who had never smoked. In addition, the RRs associated with a history of genital warts, penile rash or penile tear were 5.9 (95% CI 2.1 to 17.6), 9.4 (95% CI 3.8 to 23.9) and 3.9 (95% CI 1.9 to 7.7), respectively. Furthermore, the men with penile cancer reported more sexual partners than those without cancer, and the men with tumours associated with HPV also reported more sexual partners than those whose tumours had a negative result of a test for HPV. In a case-control study conducted in Hunan province in China, where a high rate of death from penile cancer has been documented and early circumcision is not practised, the RR of penile cancer was 32.9 (95% CI 4.3 to 253.8) among subjects who had been circumcised compared with those who had not.⁷⁵ An elevated risk persisted when the analysis was restricted to men who were circumcised more than 5 years before penile cancer was diagnosed (RR 14.9, 95% CI 1.8 to 121). Among those who had never been circumcised, those who failed to retract their foreskin while bathing were at elevated risk (RR 1.49), although this risk was not statistically significant (95% CI 0.8 to 2.8). Smoking was not identified as a risk factor. More case than control subjects reported previous STDs. Reported premarital or extramarital affairs were associated with an elevated risk. Although the number of subjects was small, making it difficult to ascertain the significance of this finding, the investigators found a greater number of genital warts, many in the same area as the tumours, during physical examination of the case subjects. The researchers did not test the subjects for HPV. Although circumcision was not routinely practised in Hunan, among the men who had been circumcised the most common reason for circumcision was the presence of a redundant prepuce or phimosis; both of these conditions were also identified as risk factors for penile cancer. These studies support the need for further evaluation of the causal role of hygiene and STDs in penile cancer.

CERVICAL CARCINOMA

HPV types 16 and 18 are the viruses most commonly associated with cancer of the cervix.⁷⁶⁻⁷⁹ Herpes simplex

virus type 2 has also been shown to be a causal agent in cervical cancer.^{78,80} A higher-than-average risk of cervical cancer has been reported among the wives of men who had been previously married to women with cervical cancer.⁸¹ As well, epidemiological studies have shown that starting sexual activity at an early age and having multiple sexual partners predispose women to cervical cancer.^{82,83} Overall, no specific cause-and-effect relation between exposure to uncircumcised sexual partners and cervical cancer has been established.⁸⁰

COMPLICATIONS OF CIRCUMCISION

Circumcision may lead to complications, which range from minor to severe. They include easily controllable bleeding,^{84,85} amputation of the glans,⁸⁴⁻⁸⁶ acute renal failure,⁸⁷ life-threatening sepsis and, rarely, death.^{84,85} The exact incidence of postoperative complications is unknown.⁸⁴ The rates of complications reported in several large case series are low, from 0.2% to 0.6%.⁸ However, published rates range as widely as 0.06%⁸⁸ to 55%.⁸⁹ Williams and Kapila⁹⁰ have suggested that a realistic rate is between 2% and 10%.

Wiswell and Geschke,⁹¹ in a survey of 136 086 boys, reported a rate of complications of circumcision and other genitourinary problems of 0.19% among circumcised infants during the first month of life and a rate of genitourinary problems of 0.24% among uncircumcised boys. Among the circumcised boys, hemorrhage, local infection, surgical trauma, UTI and bacteremia were identified. Among those not circumcised, the problems were all related to UTIs. Three of these children also had meningitis, two had renal failure, and two died. The incidence of urinary-tract abnormalities was not reported. The incidence of UTI and bacteremia was lower among the circumcised boys, at a statistically significant level, although the overall rates of complications and other problems between the two groups were not significantly different.

Therefore, the incidence of complications of circumcision, according to some reports, approaches or exceeds the incidence of UTI among uncircumcised male infants. Although some of the complications are less severe than a UTI, the incidence and cost of complications need to be included in any assessment of the cost-effectiveness of routine circumcision.

PENILE PROBLEMS DURING CHILDHOOD

The incidence of bleeding, erosion of the glans and stenosis of the urethral meatus has been reported to be higher in male infants who have been circumcised than in those who have not been circumcised.⁸⁴ Meatitis and meatal ulcers occur almost exclusively in circumcised

boys.⁸⁴ However, a retrospective survey of boys 4 months to 12 years of age showed a significantly greater frequency of penile problems (14% v. 6%, $p = 0.001$) and of medical visits for penile problems (10% v. 5%, $p = 0.05$) among uncircumcised boys than among those circumcised.⁹² Most of the problems were minor. Another study of boys in their first 8 years of life reported that the relation between the risk of penile problems and circumcision status varied with the child's age.⁹³ During infancy, the circumcised children had a statistically significantly higher risk of problems than the uncircumcised boys, but among the older children the uncircumcised boys had a significantly higher rate of penile problems, which included penile inflammation and phimosis.

These studies did not assess the possible effect of the forcible retraction of the prepuce, before it had separated naturally from the glans, on the later incidence of phimosis, penile inflammation or UTI. Is this an important factor? How common is this practice? There are articles published describing this procedure.^{94,95} The development of adhesions, bleeding and phimosis are among its reported complications.^{84,95} In general, there is inadequate recognition of the long period before the natural separation of the prepuce and glans is complete.⁹⁶ Some authors still refer to the presence of "adhesions," when, in fact, separation has not yet taken place; similarly, a nonretractile foreskin is still sometimes incorrectly diagnosed as phimosis.⁹⁷

In a study by Rickwood and Walker⁹⁸ involving 420 boys referred to their unit for possible circumcision, only 116 (28%) required the procedure. They found no true phimosis in boys younger than 5 years of age. Most of the patients had developmental nonretractability of the prepuce, and their preputial orifice, although somewhat narrow, was supple and unscarred. The authors compared this finding with data from the Mersey region of England, where phimosis was the most common indication for circumcision, accounting for 87% of the procedures, and where 390 of the 950 patients circumcised were younger than 5 years of age. They estimated that approximately two thirds of these circumcisions performed in the Mersey area were probably unnecessary.

An evaluation of hygienic practices among uncircumcised patients showed that those who retracted the foreskin while bathing were less likely to have inflammation, phimosis or adhesions than those who did not.⁹⁹ The authors of this evaluation stated that these findings supported the 1975 recommendation of the AAP³ that good hygiene can offer many of the advantages of circumcision. There is an urgent need for appropriate studies of the effectiveness of simple hygienic interventions among circumcised and uncircumcised boys and men.

PAIN CONTROL DURING CIRCUMCISION

Newborn infants exhibit physiological, autonomic and behavioural responses to noxious stimuli. These responses suggest that they experience pain, and there is evidence that preventing pain in newborns can be important.¹⁰⁰ Newborns who undergo circumcision without an anesthetic have greater increases in heart rate, cry longer and have greater decreases in transcutaneous oxygen tension than those who undergo the procedure after administration of a dorsal penile nerve block with lidocaine.¹⁰¹ Behavioural differences have also been reported. Infants circumcised without an anesthetic were reported to show decreases in responsiveness and in optimal motor performance in comparison with those who received a dorsal penile nerve block.¹⁰² These differences were still evident a day after the procedure. Furthermore, a recent report has described significantly longer crying bouts and pain scores among circumcised boys than among uncircumcised boys during routine vaccination at 4 to 6 months of age.¹⁰³

Dorsal penile nerve block has been shown to reduce the behavioural and physiological changes during circumcision^{104,105} but may have serious consequences, including skin sloughs.^{106,107} Topical anesthetic agents show promise¹⁰⁸⁻¹¹⁰ but do not take effect until 45 to 60 minutes after application. Furthermore, these agents may produce methemoglobinemia.¹¹¹ A prospective, randomized, double-blind, placebo-controlled trial involving 47 patients showed that acetaminophen did not alleviate the intraoperative or the immediate postoperative physiological and behavioural changes indicating pain.¹¹² However, it may have provided some benefit after the immediate postcircumcision period.

The use of sucrose for pain relief has also been tested. In a controlled trial, 30 normal term infants undergoing circumcision were randomly assigned to receive no intervention, a nipple dipped in water or a nipple dipped in a solution of 24% sucrose.¹¹³ The bottles of sterile water and of sucrose solution were prepared and marked so as to ensure that neither the investigator nor the physician knew their contents. The use of a pacifier dipped in sterile water reduced the percentage of time spent crying after circumcision from 67% to 49% ($p < 0.01$), and the use of sucrose on the pacifier further reduced the percentage of time spent crying to a mean of 31% ($p < 0.05$).

The evidence of the need for pain control is strong, and there is evidence of the increasing use of agents to achieve this.¹¹⁴ However, the most effective and least risky type of anesthesia or analgesia remains to be determined.¹¹⁵ Further studies are required to determine the most appropriate agents and the timing of their use.

COST-BENEFIT ANALYSES

PREVENTION OF UTI

Chessare¹¹⁶ developed a model for decisions concerning circumcision of newborn male infants to prevent UTIs. In the model, the probability of having a UTI in the first year of life was considered to be 4.1% for an uncircumcised boy and 0.2% for a circumcised boy,³³ and the likelihood of renal scarring as a result of a UTI was considered to be 7.5%.⁴⁷ The probability of minor complications was set at 21.8%, which is a much higher incidence rate than the rate of 0.19% reported by Wiswell and Geschke⁹¹ or of 2% to 10% estimated by the authors of a recent review.⁹⁰ Chessare stated that the rate of minor complications has no effect on the preferred choice. Major complications were not included because they are relatively rare. All possible outcomes were ranked from worst (e.g., circumcision followed by renal disease) to best (e.g., no circumcision and no later UTI) on a scale of 0 to 1. For the set of values assigned to the possible outcomes, the highest expected benefit was obtained from the choice not to circumcise. The choice would remain not to circumcise even if none of the infants circumcised had complications as a result of the procedure and would change only if the probability of a UTI in the first year of life was 29% or greater. The possible reductions in the risk of penile carcinoma and of HIV infection were not considered in this model.

Thompson²¹ interpreted the published data by considering a hypothetical cohort of 2000 newborn male infants, half of whom were circumcised and half of whom were not. Given an incidence of UTI of 0.1% in the circumcised boys and of 1.0% in the uncircumcised ones during the first year of life, he calculated that there would be nine more UTIs for every 1000 newborns who were not circumcised. Thus, 99.9% of the circumcised infants would not experience a UTI, whereas 99.0% of the uncircumcised group would not have a UTI. Given a complication rate of 0.2%,⁹¹ Thompson estimated that, whereas 9 boys out of 1000 circumcised would benefit from circumcision, 12 would have moderately severe complications. At a complication rate of 4.0%, 41 boys would have moderately severe or worse complications. He concluded that the potential benefit to 9 in 1000 boys would be more than offset by the rate of moderately severe or worse complications, even if this rate was as low as 0.2%.

PREVENTION OF PENILE CANCER

There have been two assessments of the cost-benefit ratio of routine neonatal circumcision to prevent penile cancer.^{6,117} However, neither assessment included the incidence and cost of the complications of

circumcision, and both assumed that neonatal circumcision was completely protective. Since circumcision does not provide complete protection from penile cancer, and other factors appear to be involved in the causation of penile cancer, this assumption is an oversimplification. Cadman, Gafni and McNamee,¹¹⁷ on the basis of an incidence rate of penile carcinoma of two cases per 100 000 men annually and of the fact that the condition almost never presents before 50 years of age, calculated that the cost of circumcising 100 000 male infants is \$3.8 million and that this manoeuvre would prevent only two cases of cancer of the penis. Cadman and colleagues then compared their estimate with Hartunian, Smart and Thompson's¹¹⁸ estimate of \$103 000 as the cost of treatment and the lost earnings of a man 50 years of age with cancer. They conceptualized the cost of circumcision as a long-term investment, which, invested at 4% for 50 years, would have a value of \$27.2 million. Hence, they estimated that the cost of prevention would be 100 times the cost of treatment.¹¹⁷ Not all factors concerning neonatal circumcision were considered, and the restriction of the analysis to purely economic factors is a significant limitation.

OVERALL ASSESSMENTS

Lawler, Bisonni and Holtgrave²⁷ used a decision tree to illustrate the consequences of the choice to circumcise or not to circumcise male infants. With the use of the Markov process,¹¹⁹ they simulated the natural history of uncircumcised patients in whom penile cancer develops later in life. They assumed there was no risk of penile cancer after circumcision.

They included in the analysis the risks of death from the surgical procedure, of surgical complications, of UTI, of death from UTI and of penile problems. For the uncircumcised patients, the analysis included the risks of penile problems (e.g., balanitis, phimosis and paraphimosis), of death from the surgical procedure when performed at a later age, of surgical complications, of UTI, of death from UTI and of penile cancer. The incidence of these events was taken from the literature. However, this incidence information varies widely, and reliable data on the incidence of phimosis and the need for circumcision later in life are lacking as a result of differences in diagnostic criteria.⁹⁷

Given an 85-year life expectancy, these investigators calculated that the expected lifetime cost of routine neonatal circumcision was \$164.61 per patient, and the quality-adjusted survival was 84.999 years. For those not circumcised, the expected mean lifetime cost was \$139.26 per patient and the quality-adjusted survival was 84.71 years. The investigators therefore concluded

there was no medical indication for circumcision or contraindication against it. According to their sensitivity analyses, if the rate of surgical complications of neonatal circumcision fell below the threshold value of 0.6%, then circumcision would be preferred, both in terms of its cost and its favourable effect on lifespan. Similarly, if the risk of penile problems among uncircumcised males rose to 17% from the baseline value of 14%, then circumcision would be preferred from a cost perspective. The authors recognized and emphasized the need for epidemiologically sound data on the surgical complications of circumcision and on the incidence and outcome of therapy for balanitis, phimosis and other penile problems, in order to better assess the risks and benefits.

Ganiats and coworkers²⁸ performed a cost-utility analysis of two hypothetical groups of 1000 neonates, one circumcised and the other uncircumcised. Their analysis included the reported differences in incidence of UTIs and of penile cancer, the estimated costs of treating these diseases, the incidence and cost of later therapeutic circumcision and the costs of neonatal circumcision and its complications. The net discounted lifetime cost of routine circumcision was \$102 per man, and the net discounted lifetime cost to health of no circumcision was 14 hours per man. The results suggested that the financial and medical advantages and disadvantages of routine neonatal circumcision cancel each other out, and that personal cultural or religious views, rather than cost or health outcomes, should be the basis for decision making.

Poland¹⁰ commented that relatively few medical procedures are routinely recommended for the care of infants and children, and that a good general principle is to withhold the routine application of procedures to large groups unless the benefits clearly far outweigh the risks and costs. Our review of the literature leads us to conclude that, for routine neonatal circumcision, the benefits have not been shown to clearly outweigh the risks and costs.

When information on the medical advantages and disadvantages of neonatal circumcision is presented to parents before they make a decision concerning neonatal circumcision, it results in little change in their decisions.^{120,121} There is evidence that parents' decision making is based mainly on social, rather than medical, concerns.¹²² The strongest factor associated with the decision about whether to circumcise a male infant is whether his father was circumcised, and concerns about the attitude of peers and the boy's self-concept are also prominent influencing factors.¹²² These concerns also need to be discussed during physician counselling of parents. Further information that addresses these concerns is required.

CONCLUSIONS

We undertook this literature review to consider whether the CPS should change its position on routine neonatal circumcision from that stated in 1982. The review led us to conclude the following.

- There is evidence that circumcision results in an approximately 12-fold reduction in the incidence of UTI during infancy. The overall incidence of UTI in male infants appears to be 1% to 2%.
- The incidence rate of the complications of circumcision reported in published articles varies, but it is generally in the order of 0.2% to 2%. Most complications are minor, but occasionally serious complications occur. There is a need for good epidemiological data on the incidence of the surgical complications of circumcision, of the later complications of circumcision and of problems associated with lack of circumcision.
- Evaluation of alternative methods of preventing UTI in infancy is required.
- More information on the effect of simple hygienic interventions is needed.
- Information is required on the incidence of circumcision that is truly needed in later childhood.
- There is evidence that circumcision results in a reduction in the incidence of penile cancer and of HIV transmission. However, there is inadequate information to recommend circumcision as a public health measure to prevent these diseases.
- When circumcision is performed, appropriate attention needs to be paid to pain relief.
- The overall evidence of the benefits and harms of circumcision is so evenly balanced that it does not support recommending circumcision as a routine procedure for newborns. There is therefore no indication that the position taken by the CPS in 1982 should be changed.
- When parents are making a decision about circumcision, they should be advised of the present state of medical knowledge about its benefits and harms. Their decision may ultimately be based on personal, religious or cultural factors.

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Mar. 31-Apr. 3, 1996: US Centers for Disease Control and Prevention 1996 Diabetes Translation Conference — Health Care in Transition: Diabetes as a Model for Public Health

Washington
Department of Health and Human Services,
Public Health Service, Centers for Disease Control and Prevention, Atlanta GA 30333

Apr. 1-2, 1996: IBC's 3rd Annual *Helicobacter pylori* and Gastrointestinal Disorders — New Approaches to Prevention, Diagnosis and Treatment

Philadelphia
International Business Communications USA
Conferences Inc., 225 Turnpike Rd., Southborough MA 01772-1749; tel 508 481-6400, fax 508 481-7911

Apr. 1-3, 1996: National Institutes of Health Consensus Development Conference: Cancer of the Cervix (sponsored by the National Cancer Institute and the National Institutes of Health Office of Medical Applications of Research)

Bethesda, Md.
Annette Designano, Technical Resources International, Inc., 3202 Tower Oaks Blvd., Rockville MD 20852; tel 301 770-0610, fax 301 468-2245

Apr. 3-May 22, 1996 (Wednesdays): Law for Mental Health Professionals (cosponsored by the Department of Psychiatry, University of Toronto)

Toronto
Isabel Granic, conference coordinator, Clarke Institute of Psychiatry, 250 College St., Toronto ON M5T 1R8; tel 416 979-4747, ext. 2643; fax 416 979-4970

Apr. 9-10, 1996: 6th Annual Palliative Care Conference — Palliative Care . . . Evolving Dimensions (presented in collaboration with Canadian Association of Nurses in AIDS Care,

Canadian Association of Nurses in Oncology, Community Hospice Association of Ontario, Metropolitan Toronto Palliative Care Council, Ontario Medical Association, Section of Palliative Care, and Ontario Palliative Care Association)

Toronto
Teresa Sottile, conference manager, Business and Industry Services, Humber College, 205 Humber College Blvd., Etobicoke ON M9W 5L7; tel 416 675-5077, fax 416 675-0135

Apr. 14, 1996: 8th Annual Symposium on Treatment of Headaches and Facial Pain

New York
Dr. Alexander Mausekopf, director, New York Headache Center, 301 E 66 St., New York NY 10021; tel 212 794-3550

Apr. 15-16, 1996: Human Resource Strategies in the New Economy

Don Mills, Ont.
Ontario Hospital Association, 150 Ferrand Dr., Don Mills ON M3C 1H6; tel 416 429-2661, fax 416 429-5651

Apr. 16-18, 1996: Community and Hospital Infection Control Association (Canada) National Education Conference — Pacific Transformation: Ideas into Action

Vancouver
Mrs. Gerry Hansen, conference planner, CHICA-Canada, PO Box 46125, RPO Westdale, Winnipeg MB R3R 3S3; tel 204 897-5990, fax 204 895-9595

Apr. 17, 1996: Basic Seminar for Physician Managers

Don Mills, Ont.
Ontario Hospital Association, 150 Ferrand Dr., Don Mills ON M3C 1H6; tel 416 429-2661, fax 416 429-5651

Apr. 18-19, 1996: 2nd Annual Conference: Therapeutic Camps for Children/Adolescents (sponsored by the Children's Outpatient Department and Recreation Discipline, Royal Ottawa Hospital)

Ottawa

Carolyn Cashman and Associates Inc., 37 Four Seasons Dr., Nepean ON K2E 7P9; tel 613 228-2883, fax 613 228-0825

Apr. 19, 1996: Sexual Victimization of People with Developmental Disabilities

London, Ont.
Child and Parent Resource Institute, 600 Sanatorium Rd., London ON N6H 3W7; tel 519 471-2540, ext. 2074; fax 519 641-1922

Apr. 19-21, 1996: 4th International Conference on Geriatric Nephrology and Urology (sponsored by the International Society for Geriatric Nephrology and Urology, the Division of Nephrology, Department of Medicine, University of Toronto, and the Nephrology Section, Department of Medicine, Lenox Hill Hospital, New York)

Toronto
Study credits available.
Continuing Education, Faculty of Medicine, University of Toronto, Rm. 121, 150 College St., Toronto ON M5S 1A8

Apr. 20-21, 1996: Pacific Northwest Radiological Society Annual Meeting

Victoria
Myra Wooten, Pacific Northwest Radiological Society, 1100-2033 6th Ave., Seattle WA 98121; tel 206 441-9762, fax 206 441-5863

Apr. 22-23, 1996: Conference for Health Care Materiel Managers

Don Mills, Ont.
Ontario Hospital Association, 150 Ferrand Dr., Don Mills ON M3C 1H6; tel 416 429-2661, fax 416 429-5651

Apr. 24, 1996: Legal Series II for the Health Care Industry — Legal Issues Facing Hospital Boards

Don Mills, Ont.
Ontario Hospital Association, 150 Ferrand Dr., Don Mills ON M3C 1H6; tel 416 429-2661, fax 416 429-5651

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